Wireless Magnetometer Vehicle Detector Stations (WMVDS) in District 4

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Caltrans has 12 districts

District 4 has 9 counties

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Traffic Operations System (TOS)

- Mainline and Ramp Vehicle Detection Stations
- Ramp and Mainline metering
- Changeable Message Signs
- Closed-circuit Television cameras
- Highway Advisory Radio Transmitters and Signs
- Transportation Management Center

Mainline Detectors

- ~500 centerline miles
- 2 directions
- 2.5 stations / mile
- 4 lanes / station
- 2 detectors / lane
- ~20,000 detectors
- D7 has 7663 (PeMS 2/12/10)

Detector Technologies

- inductive loop
- (wired) magnetometer
- magnetic
- infrared optical
- microwave radar
- video

Corridor Mobility Improvement Account (CMIA)

- Add mainline VDS to complete detection coverage throughout D4
  - I-80 Solano county
  - I-580 Alameda county
  - US-101 Santa Clara county
  - US-101 Marin / Sonoma counties
  - SR-4 Contra Costa county
  - SR-24 Alameda / Contra Costa counties

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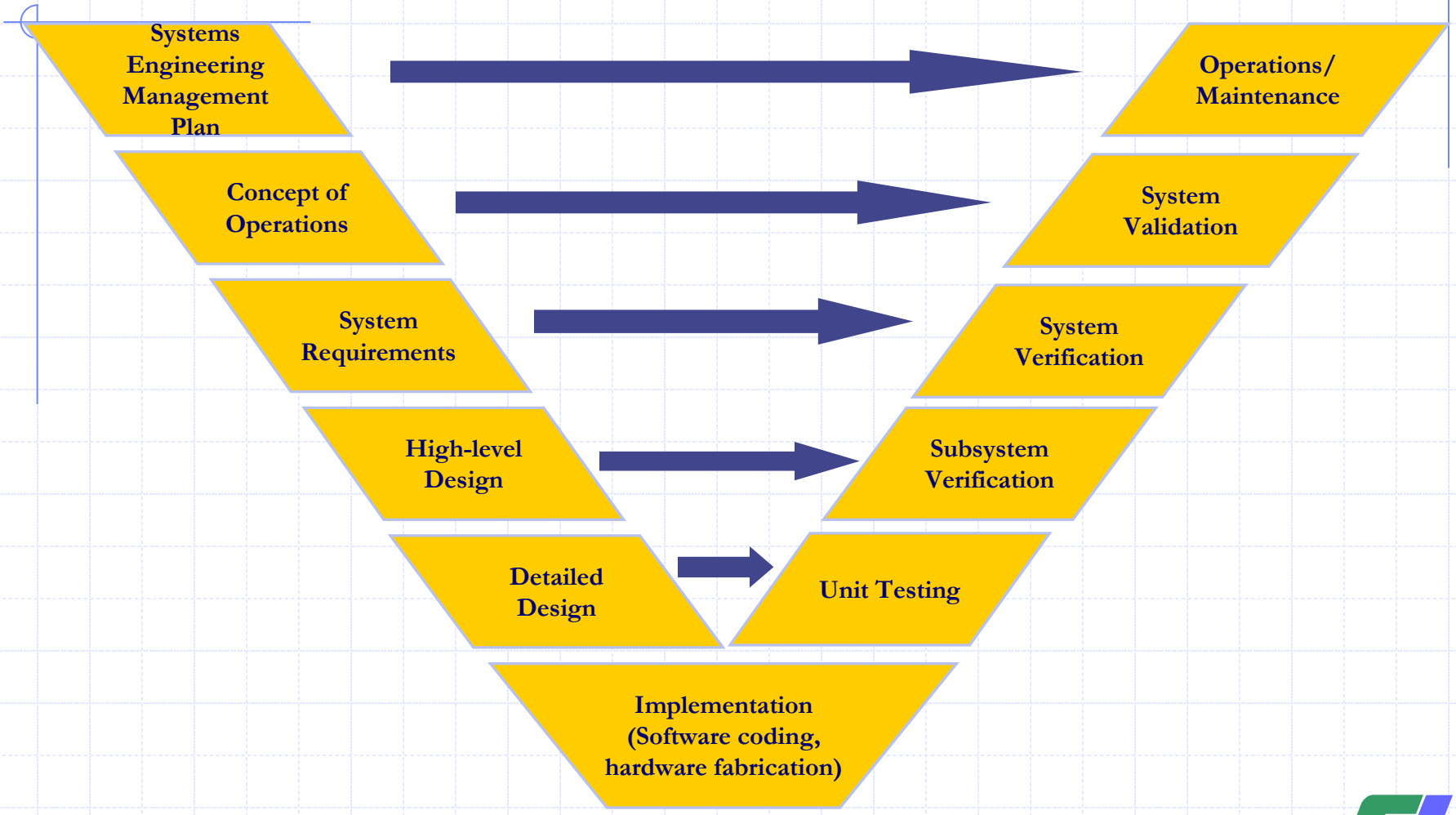
Systems Engineering "V" Model



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Top-Down Method

- Operational needs
- Algorithms
- Data set
  - Parameters
  - Accuracy
  - Precision
- Technologies

highest

lowest

Big assumption #1

- Choose technology and implementation that meets existing data set:
  - Lane volume
  - Lane occupancy
  - Lane average speed

Why choose wireless magnetometers?

- Ease of installation
  - No saw cutting
  - No service connections
  - Minimal traffic control
- Removable
- Reusable w/ “clamshell” case
- Positive experiences in D4 with wired magnetometers

So we leapt in with both feet …

- 5 construction projects
- "stand-alone" VDS
  - Solar power
  - Wireless (GPRS) communication to TMC
  - 1 or 2 VDS / location
- 560 VDS operational (1/28/10)

From sensor to data

- Presence
  - Input into controller
- Processed
  - Time sample
- Per-vehicle

Fundamental question #1

How do you know that the data **from any detector** is good?

Macroscopic verification

- "Is data reasonable?"
- Legacy Caltrans controller tests
- Jacobson, et al. (TRB, 1990)
- Nihan (Journal of Trans Engr., 1997)
- Other WSDOT

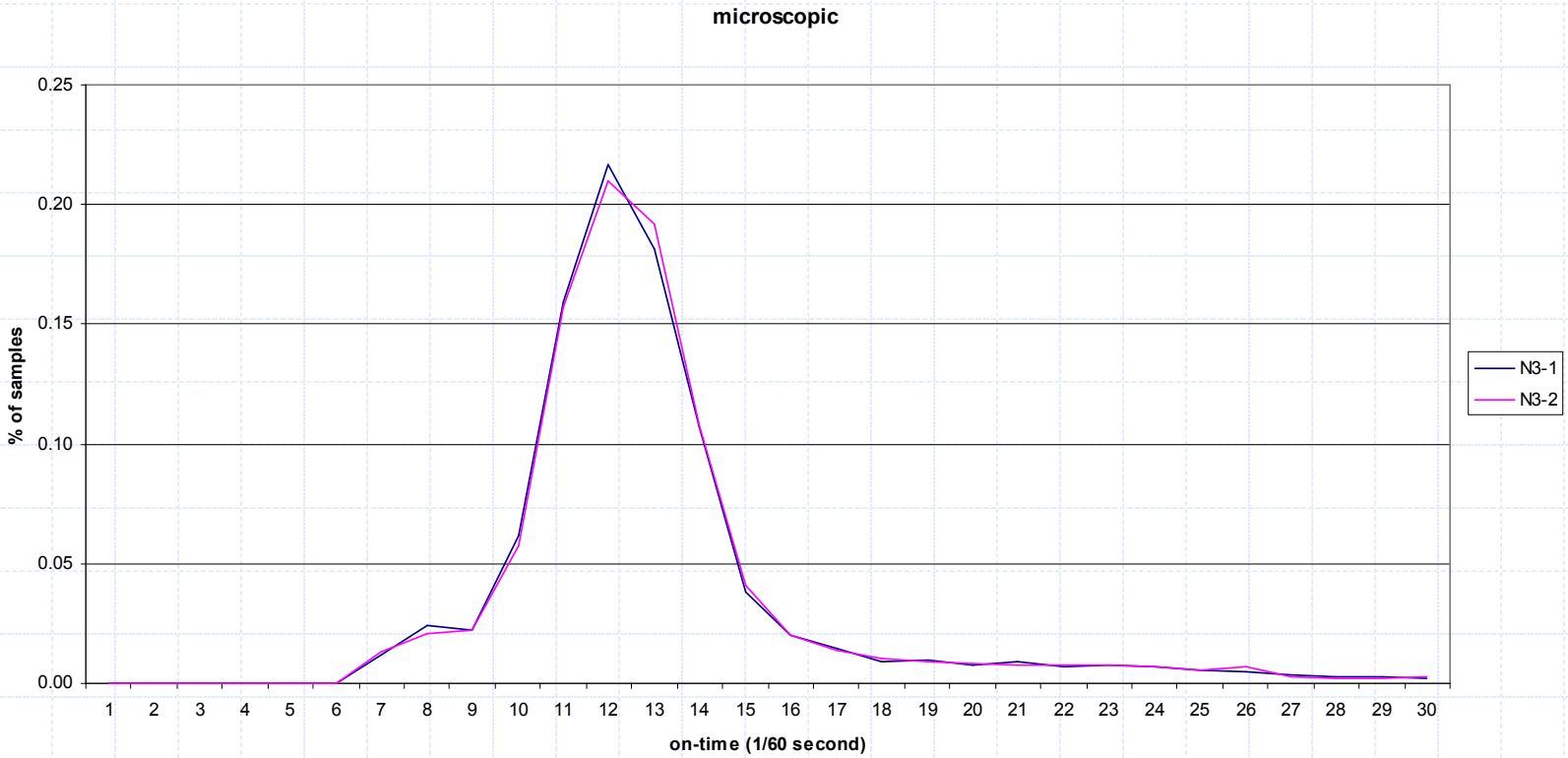
Microscopic verification

- "Is detector working properly?"
- Chen and May (TRB, 1987)
- Cassidy and Coifman (TRB, 1997)
- Berkeley Highway Lab (1999 -)

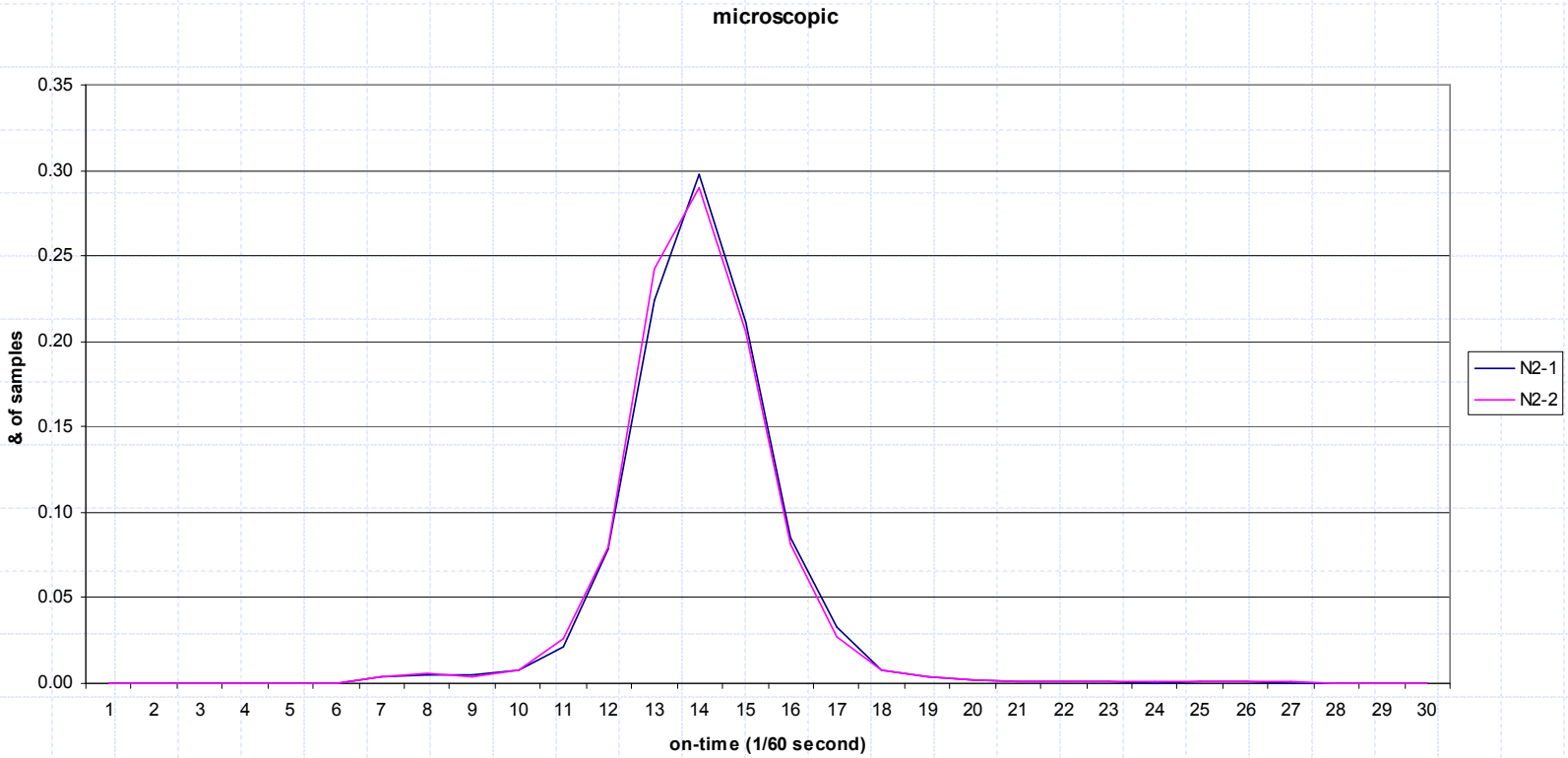
Use of microscopic tests

- Validate technologies
  - Type E (circular) loop
  - Microloop
- Validate sensors
  - Model 232E (magnetic)
  - other Model 222 (loop)

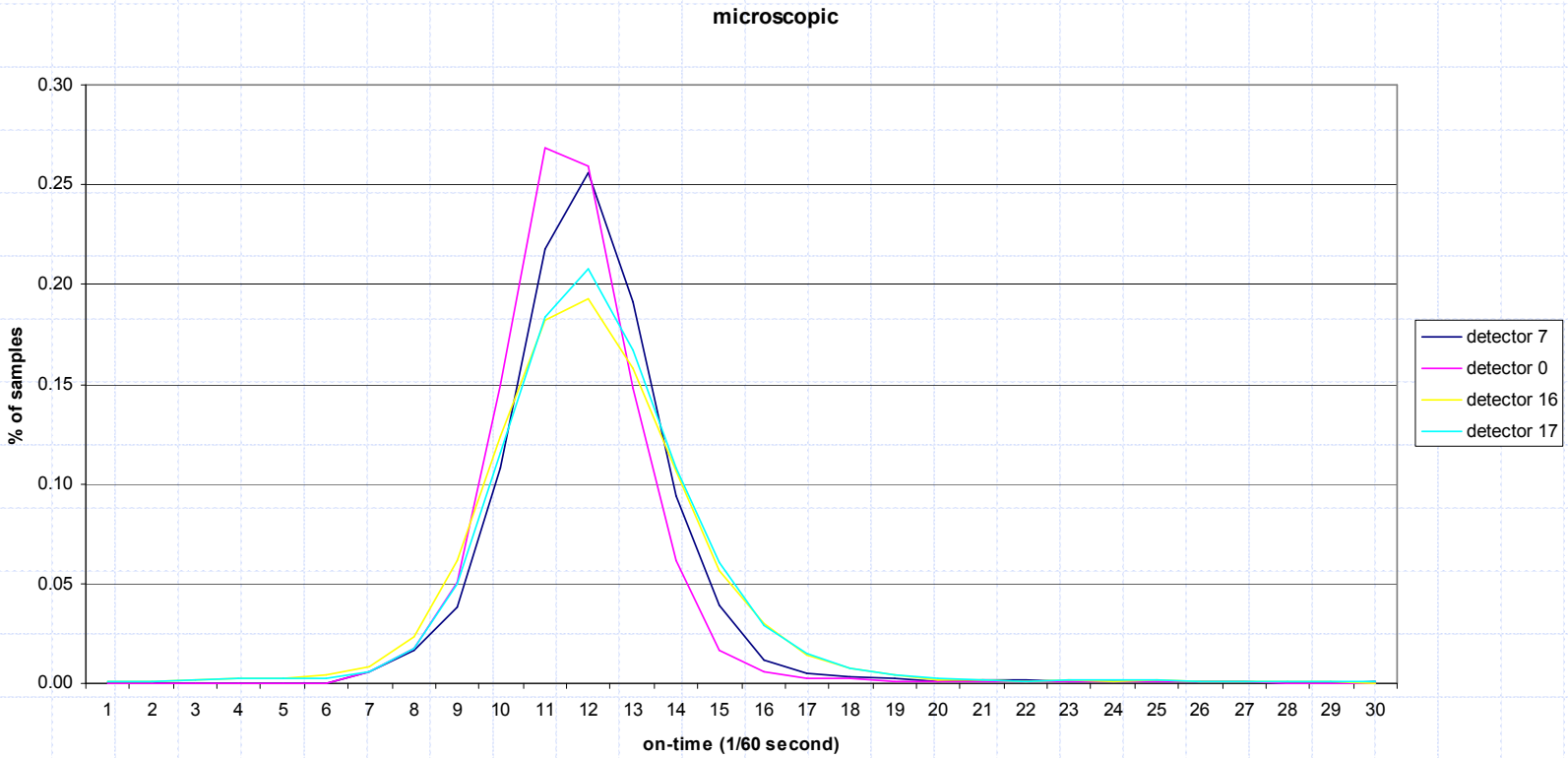
Detector on-time distribution



Detector on-time distribution



Loops versus WMVDS (2007)



More microscopic verification

Caltrans Division of Research and Innovation (DRI)

- VideoSync – synchronization of detector presence data and video
  www.dot.ca.gov/research/operations/videosync
- "(WMVDS) and Loop Detector Evaluation Report, (2008)

D4 Test Site – Ala-80 @ Ashby Ave

Preliminary conclusions:

- "accurate speed trap speeds across all conditions"
- "95+% volume accuracy in the most demanding conditions"
- "occupancy data that's more nosy than properly configured loops"
- "not considered adequate for classification or true Travel Time applications"
- development of revised filtering software that appears to mitigate occupancy problems

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Questions and Discussion